

Appendix H

Erosion Control Plan and Mitigation Plan (ECP)

Vineyard Erosion Control and Mitigation Plan
for
CDF Timber Harvest Plan and Timberland Conversion

Paul Hobbs Winery
Hillick Vineyard
11835 Highway 116
Guerneville CA 95446

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Introduction

An erosion control plan which addresses the concerns of regulatory agencies including but not limited to the California Department of Forestry (CDF), North Coast Regional Water Quality Control Board (RWQCB-NCR), and the California Department of Fish and Game (CDFG) has been developed in response to a request by G.T. Edwards RPF at Ag Wood Forestry for Paul Hobbs Vineyards, 11835 Highway 116, Guerneville CA 95446. The Plan addresses normal temporary and permanent erosion control requirements for vineyard development. A format consistent with CDFG Mitigation Plan Development Guidelines has been followed for the work.

Project Description

The property consists of about 167 acres in three different parcels west of Highway 116 in Pocket Canyon between Forestville and Guerneville. The proposed vineyard is on a north-east to south-west trending ridge crest on slopes of 5% - 35% on a property that has been logged many years ago and subjected to timber regrowth. Figure 1 shows the work site and surrounding area per the USGS 7.5-minute quadrangle map Camp Meeker at 1" = 2000' and 40' contours. Figure 2 indicates the regional geology underlying the local ridges. Another figure at 1" = 150' and 10' contours interpolated from the quad map 40' contours shows details of the Erosion Control Plan, site access, local water courses, watershed limits, property limits, and other details as determined from published resources by the Forester and Engineer. Existing on-site improvements are limited to historic ridge crest access roads and a developed spring. Adjoining property improvements are indicated, including a residence, outbuildings, and access roads.

Timberland conversion activities will commence shortly after completion of timber harvest activities and should be completed within 1-2 years. The vineyard will consist of two main blocks with final configuration dependent on site topography. Total development area is about 20 acres. The vineyard blocks will have irregular boundaries conforming to slope breaks, channel offsets, and existing access roads. Vineyard perimeter edge effects to allow for field avenues are expected to result in a plantable area of about 11 acres.

This report discusses erosion and sediment control activities associated with proposed vineyard development on the property.

Site Geology

The USGS Santa Rosa Quadrangle Map 2A was consulted to assess underlying geologic strata. The property is located on a ridge south of the Russian River, situated within a large-scale block delineated as Kjf, a Jurassic era (60 - 120 million years old) Coastal Belt Franciscan mélange formation with subsurface geology consisting of marine sandstone, shale, and conglomerate. The designations are consistent with site observation and typical of adjacent ridge top uplands.

The geologically active San Andreas fault is located about 20 miles west of the project site. Earthquakes generated from this fault or other closer sources may cause ground shaking during the lifetime of the project, but are not normally considered as a design factor during vineyard development. Distance to active fault lines and presence of bedrock at relatively shallow depth would tend to minimize potential for earthquake induced damage at this location.

The general geologic patterns indicated on the low-resolution 1:250,000 base map can be expected to show overlap and diversity in features observed on the property. Surficial characteristics at the vineyard are consistent with an uplift and erosion-derived history, varying from area to area.

The property appears to have a topography consistent with natural long-term erosion processes rather than recent or surficial land sliding processes. This is characterized as gentle swales in uplands trending to vee-shaped channel areas bisected by more prominent ridges, rather than stair-stepped benches on

the hillsides. A geotechnical investigation of the property was completed by others during planning, resulting in exclusion of any areas of known or suspected instability from the development envelope. The resulting project area does not have obvious characteristics of recent slumping or landslide activity, indicating suitability for the intended purpose of vineyard development.

Vineyard Soils

Soils in the area have been mapped on the USDA Soil Conservation Service - Soil Survey of Sonoma County, Sheet 71. Such mapping was completed using general topography, land forms, and vegetation to mark unit boundaries, supplemented by intermittent field verification, sometimes many miles from a particular project location. Soil types should therefore be verified on a site-specific basis, as the low-resolution mapping scale is insufficient to provide a high level of detail, particularly in complex topographic areas.

Area soils have been mapped as Hugo – Josephine complex HnG (50 – 75%). The Hugo series consists of well drained very gravelly loams that have a gravelly sandy clay loam subsoil. At 3' – 5' the soils are underlain by weathered, fine grained sandstone and shale. The soils are on mountainous uplands. According to the USDA reference, a typical profile includes 8" of pale brown very gravelly surface soils, with subsoils of gravelly sandy clay loam. Permeability is moderate, with fair strength, medium compressibility, and good resistance to piping. Runoff is medium, and the hazard of erosion is moderate at low slope, increasing at higher slopes.

Soils were observed at the time of site inspection in late winter in existing road cuts. In general, they appear to be consistent with the mapping units. The local soils are believed suitable for vineyard development, based on historical and ongoing agricultural activity in similar upland soils in the region. Soil amendments are typically applied in response to soil testing, in order to moderate acidity. Nutrients are applied to vineyards on an as needed basis through foliar or irrigation methods, based on annual monitoring results. Satisfactory levels of surface drainage and permanent cover crop development will be necessary to prevent formation of sheet and rill erosion.

Site Hydrology

Peak Flows: Estimates of surface runoff and associated flow rates are necessary for drainage design to meet erosion control objectives. Peak flow rate estimates were developed using Rational Method procedures. Per Plate B3 in the Sonoma County Water Agency Flood Control Manual, this ridge crest location at about 600 feet elevation has an estimated average annual rainfall of about 50" (4.2'). For the 100-year 15-minute storm at 2.4 inches/hour and a 40% runoff factor, design flows are estimated at $Q = .40 \times 2.4 \times (50/30) = 1.6$ cubic feet per second per acre. Peak flows for the USDA Type II storms expected in coastal California have relatively short duration, with the flows noted expected for only a matter of minutes. In a 24-hour period, estimated flow rates will exceed 2/3 of the values noted for only about an hour.

Time of Concentration and peak flows from individual vineyard sub-watersheds will be similar for both pre-construction and post-construction conditions. Low-slope vee ditches have been used to direct sheet flow to drain lines where piped drainage is specified. The low-slope, more serpentine flow path compensates for the faster piped flow, resulting in similar pre-construction and post-construction flow volumes and flow time of concentration. In general, runoff patterns have been maintained. Sheet flow from the westerly uplands is partially diverted through a proposed hilltop irrigation reservoir.

Water Quality and Quantity Evaluation

Vineyard water source: An 11 acre-foot reservoir is proposed as part of vineyard development. For a typical planting density of about 1100 vines/acre, the seasonal water demand at 5.8 gal/vine/week is about 100 gal/vine/season or 0.334 acre-feet per acre per year over 11 acres and can easily be met by an 11 acre-foot reservoir, as shown in the attachments. The water demand is about 3.6 ac-ft for irrigation, and with a 20% seepage and evaporation allowance of 2.2 ac-ft, a residual of 5.2 ac ft is expected. No water for frost protection is believed required or has been specified for this ridge top location, because cold air drainage and frost occurs primarily in valley or flat bottomland situations.

Vineyard tributary areas: The proposed vineyards are on a ridge crest that drains via a number of subwatersheds in different directions. Upland tributary areas will be developed to collect sheet flow runoff. Relative to the impoundment, about 3.5 ac NW, 6.3 ac NE, 1.9 ac SE and 1.0 ac pond surface are available. Collection will be via low-slope sheet flow collection ditches and piping at 5% or greater around the hillsides. Total collection area is about 11.7 ac uplands and 1 ac pond surface.

Reservoir watershed runoff yield estimate: Sonoma County Water Agency maps (Plate B-3, Flood Control Design Criteria) indicate the average annual local precipitation is on the order of 50" (4.2 feet) per year. Assuming a 50% runoff factor implies a watershed unit yield of 2.1 ac-ft-ac/annum. This amounts to a winter runoff volume of about 24.6 ac-ft/annum (afa) for the cumulative 11.7 acre vineyard watershed directed to the proposed reservoir. An additional 4.2 acre-feet will be captured by the 1 acre reservoir surface, for an average-year 29 ac-ft watershed yield, about twice that needed for filling a dry impoundment. With an average year residual of perhaps 5.2 ac ft, the recharge volume would be reduced to 5.8 ac ft for a yield-storage ratio of about $29/5.8 = 5:1$. The reservoir would also be expected to fill in relatively dry years as well, when runoff is reduced by up to 1/3.

Project impact on runoff yield to downstream channels: Surface runoff will occur during winter months and is unavailable during low-flow summer conditions with or without project implementation. Winter runoff before and after project implementation is a function of soil type and vegetative cover. Soil type and condition will remain the same after project implementation. A permanent grass cover crop will be substituted for second growth timber and brush, with believed similar infiltration rates, so runoff should not be appreciably changed as a result of project implementation.

Forest evapotranspiration considerations: An unknown, variable fraction of the surface infiltration would be partitioned into seasonal soil evaporation and watershed vegetative evapotranspiration, and would not be available for late-season return flows. For a 5-month growing season assuming a cool coastal climate, a reasonable forest land evapotranspiration value would be on the order of 0.1"/day, for a monthly evapotranspiration demand of 3" and a seasonal demand of 15".

Actual evapotranspiration rates are dependent on seasonal weather patterns, vegetative cover, and soil types within the watershed. Evapotranspiration during the winter runoff season is at a relatively low rate and would not significantly affect winter runoff flows. However, over the course of the growing season the existing and surrounding forests would remove about 1.0 to 1.5 afa from the soil profile, otherwise available for late season return flows. This condition will occur whether or not a vineyard is installed in the watershed.

Vineyard evapotranspiration considerations: The vineyard demand of 0.334 afa (discounting applied water) is much less than the projected forest canopy demand of 1.0 - 1.5 afa. Vineyard installation may therefore increase late season downstream return flows by a modest amount, because the conversion of 1/5 of the watershed results in vegetation with lower evapotranspiration demand.

Infiltration to groundwater: Rainfall infiltration in excess of soil water holding capacity migrates by gravity to a depth beyond the plant rooting zone. This volume is not available for evapotranspiration use by either existing forest canopy or proposed vineyard and grass cover crop canopy. Deep infiltration occurs mainly

during the winter rainfall season, when excess moisture is available and crops are dormant and the forest canopy is at a minimal growth rate. Deep infiltration rates within the vineyard area may be slightly increased relative to a forest canopy, due to non-existent water demand during the dormancy period. The vineyard development is therefore not expected to have any negative impacts on summer groundwater supplies.

Dry season water quality issues: Vineyard runoff is not expected to occur under dry season conditions. During the dry season, groundwater return flows maintain stream flow. Premium vineyard operations typically use a near-deficit irrigation strategy applied by a precise drip irrigation system. No excess irrigation water will therefore be available for deep percolation to groundwater. Vineyard operations are therefore independent of both surface and subsurface water during the dry season, and will have no impacts on downstream Class I stream in-channel water quality during summer months. The reservoir capacity is suitable to allow irrigation through a 2-year drought cycle.

Vineyard Runoff System Design Considerations

All vineyard development areas have been excluded from Class III watercourses, so concentrated flows in channel or gully areas will not be encountered within the vineyard. Use of piping systems is not considered necessary in the low slope upland areas.

When used, drainage design for a particular watershed is accomplished on an individual basis by determining tributary area, developing a peak total flow based on the unit area rates, and selecting a pipe size and location appropriate for handling the design flows. Attention to detail is important regarding pipe placement, pipe bedding, inlet configuration, inlet design, outlet armor, and other features in order for the structure to function as intended. Quality assurance is provided by using qualified installers and County-mandated inspections during installation of permitted projects. For this property, drainage configurations will be determined on an individual basis at the time of vineyard development to account for such variables.

Mitigation for any vineyard runoff includes measures to limit flow velocity and exposure to unprotected soil as discussed in the Erosion Control Methods section below. These measures include but are not limited to temporary soil mulching, development of permanent cover crops, control of slope for rows and terraces that concentrate runoff, and where used, placement of rock armor, diversion structures, inlets and drain pipes to prevent erosive flow concentrations and water velocity during runoff events.

Where concentrated runoff is directed into the heads of draws, where there is no defined watercourse channel, the final design will consider the potential effect on slope stability. If the flow directed to an area by the vineyard drainage system would be greater than the flow that historically drained to that area, then flow will be mitigated by spreading the flow adequately, or carrying the flow down to a defined watercourse, or other appropriate method. Alternatively, the Geotechnical engineer may evaluate the stability of the discharge location, and if it is determined that it would remain stable with the proposed increased flow, then no additional mitigation for slope stability would be required.

Watershed areas for individual vineyard blocks are relatively small as shown on the attached sketches based on the USGS quadrangle map. This is due to location of individual vineyard blocks on discrete hillside areas and because individual blocks discharge into different headwater tributary watercourses. Watershed peak flows at vineyard outfalls will be developed as part of the drainage evaluation.

Reservoir Outfall: Portions of the upland sheet flow will be captured and directed to the reservoir. Under early season runoff, the reservoir will not be full, and no discharge is expected. Under normal operation with the impoundment pool at design level, moderate discharge rates are expected. The weir type overflow requires an increase in water storage depth in order to operate at the same flow rate as the instantaneous inputs. The 1-acre surface area must be raised by 6"-12" for this to occur, so the stage-discharge characteristics of the reservoir with weir outlet act as an effective shock absorber for the system, damping peak flows by perhaps 30% while prolonging flow above background levels.

Under the 100-year 15-minute design flow from the 11.7 ac uplands, reservoir inputs may be on the order of 18.7 cfs, with another 4 cfs generated from the impoundment surface. This runoff will be safely and non-erosively conveyed by an over-sized pipe downstream to a rock-armored energy dissipater prior to outlet into a Class III waterway. To maximize protection of downstream resources, the discharge will be routed from the ridge top saddle area to the south west, away from an existing water system and residence located 350' and 1000' respectively towards the north east. The oversized pipe will operate only part full at design flow, providing greater friction and lower discharge velocity, as well as redundant capacity in the event of extreme runoff events or trash or debris in the system.

Earthwork Considerations

County Permits: Earth work with cuts and fills greater than three feet or quantities in excess of 50 cy fill are subject to County review and approval. For this vineyard, soil disturbance will be kept to a minimum for optimal viticultural performance, so that a grading permit for vineyard development activity is not believed required. However, drainage system development will require a similar evaluation for the drainage review permit.

Avenues: Perimeter avenues will typically be placed on side slopes of 5-20% so that minimal grading will be required for installation. No fill is planned for placement at the head of any draw. In the event that short hillside sections exceed 35% or fill exceeds 5', the geotechnical engineer shall evaluate the effect of proposed avenue fill on slope stability, and the fill section designed accordingly. Construction techniques would be expected to include level benched fills at 90% compaction, starting with a level keyed area, and would contain subdrains if evidence of seepage or seasonal groundwater was present.

Reservoir: A plan will be developed for the proposed vineyard reservoir, and separate grading permit obtained for that work. Sonoma County requires both Geotechnical and Civil engineering assessments and design for such improvements, so that all aspects of embankment construction and stability will be reviewed and considered. The reservoir design will be based on recommendations contained in a comprehensive geotechnical site investigation. The Civil Engineer anticipates that the impoundment will be lined with a synthetic material to ensure low to zero risk of seepage, to maximize storage efficiency, to mitigate for potentially permeable construction materials and substrate in the ridge crest area, and to maximize safety factors relative to surrounding areas and downstream improvements.

Vineyard Layout Considerations

A conceptual vineyard layout is shown on the attached drawings at 1" = 150' and estimated 10' contours. The Engineer anticipates completion of a detailed site topographic survey after land clearing for conformance with Sonoma County Vineyard Erosion and Sediment Control ordinance criteria and to facilitate a more detailed assessment of vineyard layout and related erosion control facilities. Adjustments to the proposed layout shown may occur at that time to better achieve design and viticultural objectives when the more detailed map becomes available.

Vineyard blocks on site will be developed on hillside slopes ranging from nearly level to an average 25 percent. Some areas with lesser slopes are located on ridge top areas, and small inclusions of greater slope on larger hillside areas have been incorporated where surrounded by lesser slopes or where necessary to accommodate efficient field layout and equipment operation.

The row layouts will be generally perpendicular to slope, in order to maximize plantable area and to minimize need for sidehill terraces. An extensive cover crop and other improvements will be provided to control surface runoff. Low-slope vee ditches will drain to surface drains where noted and perimeter avenue waterbars where appropriate. Hillside of similar slope have been successfully developed and are in production elsewhere throughout the County.

For this vineyard, outsloped disc terraces will generally not be necessary. If used, they will be only in locations where the combination effect of efficient field layout and sidehills at 25% or greater make uphill/downhill farming impractical. A proposed vineyard layout schematic is provided in the attachments to illustrate drainage and erosion controls. Final layout configuration will be conditional upon vineyard block areas considering drainage, erosion potential, worker safety, equipment traffic patterns, and similar factors.

Vineyard Installation Activities

Development work will begin in summer of the year of permit issuance for the CDF Timber Harvest Plan and Timberland Conversion. The vineyard owner intends to develop the vineyard according to high quality industry standards.

Work on the cleared land includes stump removal and stockpile for burning, root removal, minor shaping where required, soil amendment application, deep ripping, and vine row installation. Terracing may be completed on unripped hillsides where required, and drainage and erosion control features will be installed in conjunction with vineyard development.

Work will be conducted during spring, summer, and fall months. Erosion control and sediment retention components will be in place on a temporary basis as required during the construction season, and on a seasonal or permanent basis prior to onset of winter rains. A typical operational sequence includes:

- Placement of temporary erosion control measures around work areas.
- Tree and stump removal and stockpiling, or disposal.
- Surface shaping and grading as desired/required to facilitate efficient vineyard layout.
- Deep ripping to break up roots and modify soil structure.
- Rough grading or shaping as required to smooth field irregularities, improve drainage, modify field layout, or meet other management objectives.
- Concurrent root picking using hand or mechanical means to remove materials down to 1" diameter or less.
- Disking the rough field to smooth contours.
- Final land leveling as required.
- Engineered layout of field terrace locations, grades, drainage where used.
- Terrace construction where used.
- Layout of general field row and avenue locations.
- Installation of surface and subsurface drainage features consistent with terrace, row, and avenue placement.
- Vineyard installation, including row and vine layout, training stakes, drip irrigation lines.
- Installation of irrigation water system components.
- Installation of soil mulch and cover crop components.
- Installation of permanent erosion control measures.

Erosion Control Methods

The landowner has high expectations regarding installation and operation of a premium quality vineyard over an extended time period at this location. The vineyard system will therefore be designed and installed using extensive erosion and sediment control features, consistent with recommendations, practices, and standards of:

1. Erosion and Sediment Control Field Manual, San Francisco Bay Regional Water Quality Control Board, 1996.
2. Hillside Vineyards Unit, Redwood Empire Target Area, Napa and Sonoma Counties CA, USDA Soil Conservation Service, 1985.

The final design and installation will include the following general components:

- Season of Construction:
 - Work will be deferred until after threat of significant winter rainfall is over. County vineyard ordinance rules prevent earthwork type activities prior to April 1. For non-grading work conducted prior to mid-April, temporary erosion control measures will be in place prior to onset of earthwork. A typical construction planning and sequence list is included below.
- Field layout considerations:
 - Hillside vineyard rows:
 - Permissible on slopes to 30 - 40%.
 - Temporary and permanent cover crop required.
 - Hillside terraces:
 - Required for slopes over 40%.
 - Maximum side slope of 10% to designated drainage facilities.
 - Uniform slope to outlet to prevent ponding, over bank runoff.
 - Inboard sloped where required to direct flow to inlets.
 - Temporary and permanent cover crop required on cut and fill slopes.
 - Terrace spacing, cut and fill slopes consistent with material and slope stability.
 - Areas scheduled for terracing should not be deep ripped to maximize soil structure and integrity for terracing operations.
 - Field avenues and perimeter roads:
 - Include drainage and runoff controls.
 - Temporary and permanent cover crop required.
- Control of surface runoff:
 - Row lengths maximum 100' between drainage improvements.
 - Individual drainage inlet on each terrace.
 - Underground drain lines used in swales and concentrated flow areas,
 - Armored inlet and outlet structures,
- Erosion controls for hydraulic structures:
 - Rock-lined existing hillside gully channel,
 - Rock-armored culvert outlets,
- Subsurface seepage controls:
 - French drains in known seepage areas
 - Drain discharge into surface drains or runoff swales
- Equipment and vehicle separation from swales and waterways:
 - Culvert crossings,
 - Spillway inlet/equipment crossing,
- Sediment basins, where specified:
 - Considered secondary or backup system to minimize risk of accidental discharges
 - Locate at outfall of major swale drains
 - Piped outlet or weir overflow to existing natural channels
 - Outlet structures sized to watershed
 - Accessible for future cleanout using excavator or backhoe.
- Vineyard access roads:
 - Crowned and graded to prevent flow in wheel tracks
 - Water bars at 100' o.c. max for slopes over 15%
 - Culverts installed through seasonal swales or runoff areas
 - Ditches graded and shaped
 - Cut and fill slopes consistent with slope stability, available access corridors.
 - Sidecast material stabilized by slope limits, compaction, mulching, seeding.
- Spoils management:
 - Vineyard work results in balanced cut and fill areas with no net excess or deficit of materials.
 - Temporary stockpiles (e.g. topsoil) placed on ridge tops, areas with no runoff potential.
 - Seasonal erosion control methods as required practiced around temporary stockpiles.
- Erosion control vegetation:

Permanent cover crops using annual, perennial, and native grasses.
Temporary cover provided with straw mulching.

Minor intermittent sheet and rill erosion between terraces or rows is possible until vegetative cover for erosion control is fully established. Sediment loss potential from the vineyard is considered low, because runoff quantity from individual rows will be small and the vegetative and straw mulch cover will restrict runoff flows to non-erosive velocities.

For temporary sediment control on hillside slopes, the following improvements will be provided on an as-needed basis: A contour furrow will be constructed at base of the hill, with a companion fiber roll and geofabric fence to collect surface runoff and minimize sediment loss from hillside. Any concentrated runoff will be directed to a small sediment catch basin at the contour furrow outfall, with piped outfall of sediment-free water to the creek channel below.

After vineyard improvements are completed, slopes will be planted with appropriate erosion control grasses, including permanent native grasses, annual rye, Zorro fescue, and clover species, fertilized at 150 lb/ac of 16-20-0 granular fertilizer, and mulched with small grains straw at a rate of 2 tons per acre. Erosion control revegetation will be completed prior to October 15. Irrigation may be provided if required to establish growth of residual and hand-broadcast grass seed.

All work in upland areas is believed exempt from California Department of Fish and Game Stream Alteration Agreement requirements. However, conditions noted in a typical Agreement will be followed as a matter of conservative and environmentally-sensitive construction, including:

- Completion of earthwork in such a manner and of such materials to prevent future erosion which will contribute siltation to any watercourse below the site.
- Revegetation of all exposed slopes with seeding, mulching or other erosion control measures prior to winter rains.

No surface runoff flows are expected during construction activities, which will take place between Spring and Fall when chance of rainfall is minimal. Flow diversion around the worksite is not believed necessary.

If necessary, fiber roll silt detention materials may be placed across the head of Class III channels below the disturbed work areas. The barrier will separate the downstream channel from potential non-point source sediment loading from the work area. Where used, fiber rolls and other techniques will be maintained as required to ensure satisfactory performance of the erosion control system. All earthwork construction activities will be completed during summer months. Subsequent erosion and sediment control efforts are focused on maintenance, management, and fine-tuning of existing improvements.

Chemical Contamination Potential

No heavy metals are known or believed to be present at this agricultural site, based on an understanding of historic land use on this forested property. No mining sites, or other practices associated with heavy metals or possible high pesticide or chemical usage are known or believed to be present. No materials deleterious to waters of the State are known or expected to impact, potentially impact, or enter dry channels or surface waters during construction. This includes petroleum products for use in construction equipment, agricultural chemicals, fertilizers, and the like.

If used, any fertilizer, herbicide, insecticide, or other agricultural chemicals in this vineyard will be at low, safe, and least-cost agronomic rates according to label direction by qualified, properly certified vineyard management individuals. Material use at agronomic rates will be limited to the plant growing season, which does not occur during the winter runoff season. Vineyard fertilizer is normally applied through the drip irrigation system. Use of non-agronomic fertilizer rates will damage the plant, which will not and can not occur in a high-value closely monitored crop. Drip irrigation is an efficient low-volume method of materials application and delivery, with rates matching crop needs. Deep percolation of fertilizer to

groundwater will therefore be highly unlikely. Handling, use, and storage of all chemicals is governed by Federal, State, and local statutes, and occurs within restricted farmstead areas remote from field application sites and remote from any receiving waters. Contingency plans will be developed as required by statute, in conformance with industry Best Management Practices.

Estimated Sediment Yields

The intent of this erosion and sediment control plan is to minimize potential for man-made erosion and associated sediment and bedload transport from vineyard sites. Adherence to plan elements should result in similar erosion potential for both pre construction and post construction conditions.

Preconstruction sediment yields have not been estimated for this project. Available theoretical methods, such as the USDA Soil Conservation Service Universal Soil Loss Equation (USLE) have been developed by others for relatively uniform low-slope large-scale midwestern agricultural conditions and may be inappropriate for western hillside environments. Theoretical soil loss is a function of:

- **R, rainfall intensity and runoff factor.** This is estimated from NOAA 2-year, 6-hour precipitation values. This zone-based exponential power function uses a multiplier that is 1.6 times greater in Zone 2 than Zone 1. A statewide map shows the zone break in the northwest quadrant of Sonoma County.
- **L, Length of run.** Distance water travels in the area subject to erosion.
- **S, Slope of run.** Average field or subarea slope.
- **LS Factor.** Several empirical power functions have been developed that provide different exponential relations for length and slope in temperate, desert, and mountain climate areas. For temperate California, computed values vary 600-fold from about .07 for very short, low slope conditions to 43.5 for .23 mile reaches at 60% slope.
- **C, Vegetative cover factor.** Parameter values have a 33,333% range, from .003 for continuous perennial grass with 100% cover to 1.000 for clean tilled fallow with no cover. For vineyards, 1978 USDA CA Tech Guide Sec. II-D-2 indicates a 14,300% range of .007 to 1.000.
- **K, Soil erodibility factor.** An arbitrary set of 12 values with 640% range, from 0.10 to 0.64 has been assigned to every identified soil in the State by USDA staff. Values for an individual soil are affected by average slope.
- **P, Cropping and/or management practices.** This factor accounts for various contour tillage and crop rotation practices as a function of slope, with a range of 0.3 for low slope contour rotations to 1.0 for annual tillage perpendicular to slope.
- **A, Area affected, acres.**

As implied above, the technique relies on extensive experience to make arbitrary assignments of a number of empirical parameter values. Small changes in the exponential power functions R and LS have enormous impacts on theoretical soil loss rates. Parameter values C, K, and P affect results in a linear manner. Credible experts can predict theoretical erosion rates varying by several orders of magnitude for any given project, depending on arbitrary assignment of the linear parameters alone. Correlation between theoretical values and actual watershed yields are hard to quantify, have not been experimentally quantified for vineyards, and would be critically dependent on surface runoff, duration and intensity of storm events, and other similar factors.

From a practical standpoint, length of run is the only management variable, for a given site and set of cultural practices. For sites with higher annual precipitation, steeper slopes, more erodible soils, less vegetative cover, and more annual tillage, distance that rainfall runoff travels prior to being intercepted and conveyed to a drainage system should be minimized.

Presence of a permanent cover crop will minimize sheet and rill erosion potential. The surface erosion and sediment yield potential for a properly installed and maintained hillside vineyard is therefore estimated to be similar to the pre-existing site conditions. The vineyard sediment retention structures will further function as a bedload transport trap for upland sources, reducing contribution to downstream channels. Therefore, no increase in baseline sediment transport is expected from the entire vineyard system.

Conversion from second growth forest cover to continuous cover crop for vineyards does not necessarily lead to increased peak flows or additional sedimentation in the downslope Class III watercourses. The existing background natural sediment transport rates are non-zero, and can be increased by several orders of magnitude under wet-year conditions. This observation is intended to place the proposed development within context, and to point out that a zero net discharge is not an appropriate criteria by which to judge new vineyard performance.

Sediment Delivery Assessment: Vineyard development per ECP design will limit sheet flow lengths to about 100' in the vineyard. Vineyard sheet flow will be dispersed using fiber roll checks or directed to low-slope contoured and vegetated vee ditches that will have non-erosive water velocities. The vee ditches discharge to pipe drains and perimeter water bars with sediment traps, so that runoff water is expected to be clean and sediment free.

Soil Improvements: Soil amendments are applied on the basis of scientific testing, are used in a single initial application to make a long-term balance in soil chemistry. They tend to improve infiltration and vegetative performance, reducing erosion potential. A mineral supplement application rate of 1000 lb/ac amounts to about 10 cubic feet per acre or about .003" depth. This volume will not be visible or discernible once incorporated into the soil and will have no impact on soil stability or surface runoff water quality.

Vineyard Ordinance: Sonoma County has adopted a Vineyard Erosion and Sediment Control Ordinance, which is applicable to the subject vineyard development. These statutes impose procedural requirements and industry-wide Best Management Practices that result in low to non-existent levels of vineyard erosion. Significant regulatory mechanisms are in place, that allow Agency response and appropriate penalties to developments that do not meet performance goals, whether or not an ECP plan is in place. The Engineer believes that vineyard installation and maintenance in conformance with County ordinance requirements will result in a project with no increase in baseline sediment transport relative to historic background levels.

Mitigation Measures: All phases of project implementation will be in conformance with applicable Agency regulations. The Erosion Control Plan is believed in conformance with Sonoma County design criteria and with the VESCO statutes. These plans incorporate industry-standard Best Management Practices intended to reduce impacts to a level of insignificance. Erosion control measures used may include, but are not limited to mulching of disturbed areas, seeding, fertilizer, revegetation, fiber roll checks, silt fences, jute and straw netting, rocked fords, water bars, low slope vee ditches, pipe drainage, rock armor, sediment basins, and vegetated filter strips. The proposed water development for vineyard needs will utilize winter runoff water with low habitat enhancement potential otherwise lost. These measures are used industry wide and are believed suitable for the proposed vineyard development and suitable for attaining and maintaining mandated water quality standards.

System Maintenance

The surface runoff and erosion control system is believed conservatively designed, and should function satisfactorily with normal and routine maintenance. Annual maintenance work will consist of inspection and as-needed repair of:

- Permanent hillside cover crop as required.
- Terrace inlets, outlets.

- Swale surface drainage improvements
- Hillside vineyard/cover crop drip irrigation system.
- Culvert inlets, outlets, rock armor systems.
- Vineyard channel swale rock-lined ditches.
- Field road and avenue water bars.
- Roadside ditches, banks.
- Seasonal water bar checks as required.
- Individual sheet/rill erosion sites.
- Inboard ditches on terraces.
- Underground pipe inlets - clean trash, maintain grates.
- Seasonal re-establishment of permanent cover crops on an as-needed basis.
- Consider additional underground drain lines if small-scale problem drainage sites are identified.
- Deer exclusion fences.
- Other items as required to maintain system function.

The responsible party for vineyard maintenance activity is the landowner or a qualified vineyard management company working under direction and direct supervision of the landowner.

System Monitoring

Minor potential for sediment transport by surface runoff to receiving waters is believed the only undesirable material expected from this vineyard. Any agricultural fertilizer or chemicals will be used at label rates, consistent with Agricultural Commissioner requirements. No process water will be generated on site. Therefore, water quality monitoring is not believed required. Imposition of an extensive scientifically-based sediment yield monitoring program is inconsistent with the nonexistent or very nominal regulatory water quality constraints imposed on other local growers. The erosion control system component monitoring will therefore be conducted on a traditional visual basis over an appropriate time period, with the landowner or vineyard manager identified as the responsible party. CDFG recommends a 5-year monitoring program in their draft Erosion Control Plan outline. The following monitoring program is recommended:

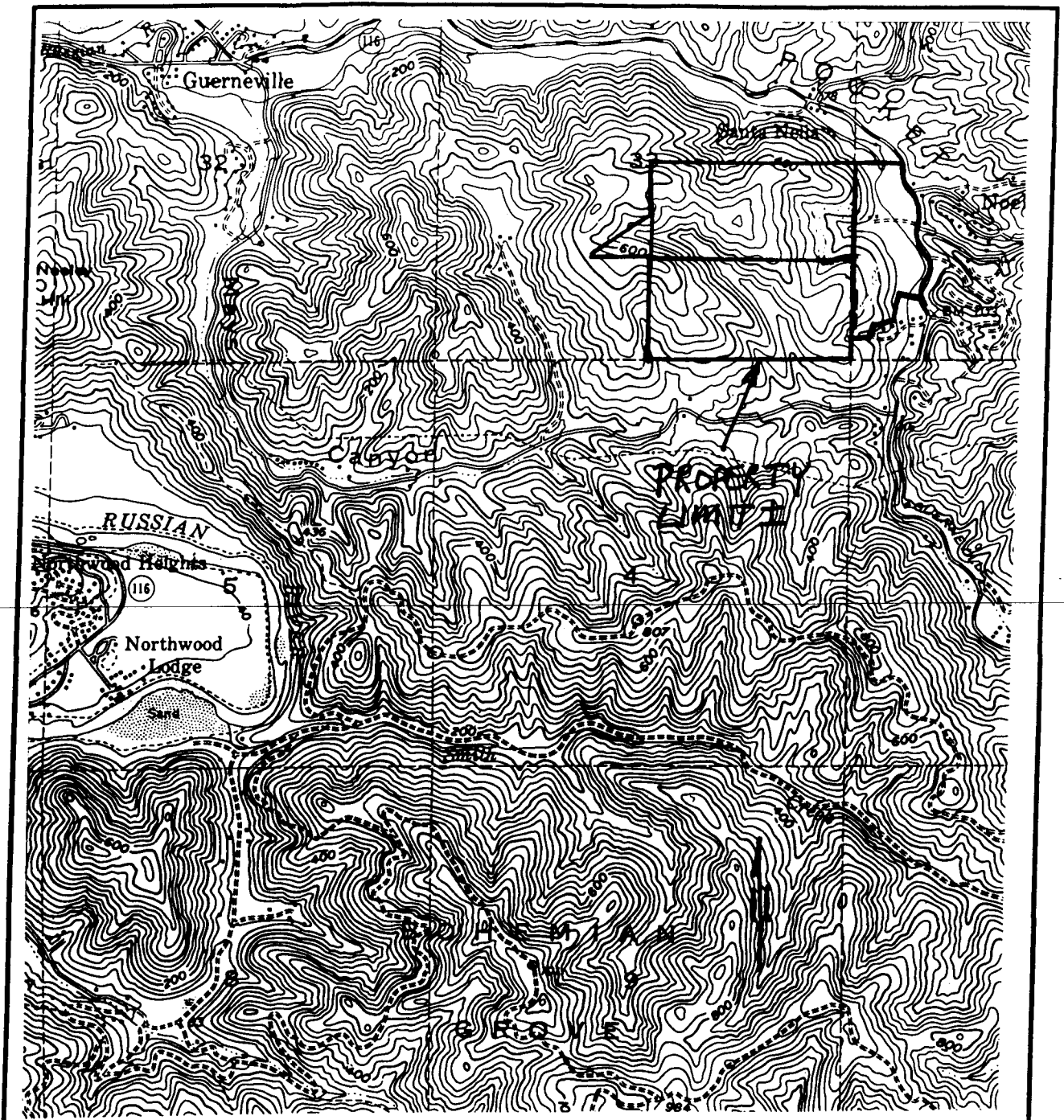
1. Establish permanent hillside cover crop of annual and perennial grasses in the Year 1 growing season.
2. Review a winter-preparedness monitoring checklist prior to October 15 on an annual basis.
3. Inspect all hydraulic features and storm water control facilities prior to October 15. Maintain/repair as required to obtain desired performance.
4. Monitor all drainage features during and after major winter storms.
5. Take remedial action as required to ensure function of drainage systems on an as-needed basis.

Summary

The vineyard development project has been described, along with a companion erosion control plan. An overview of processes affecting erosion and erosion potential for the vineyard have been summarized. Geologic, soils, hydraulic, and watershed-related factors have been considered. Vineyard factors necessary for minimum erosion potential and impact to receiving waters have been evaluated, including layout constraints, drainage design, management, scheduling, and maintenance. Specific erosion control methods appropriate for vineyard development activities are summarized, as are technical resources available for documenting such techniques. Chemical contamination potential and sediment yield estimation techniques are reviewed. A general seasonal timetable has been provided for site development work. System maintenance and monitoring requirements are outlined, as is an annual maintenance checklist.

List of Figures

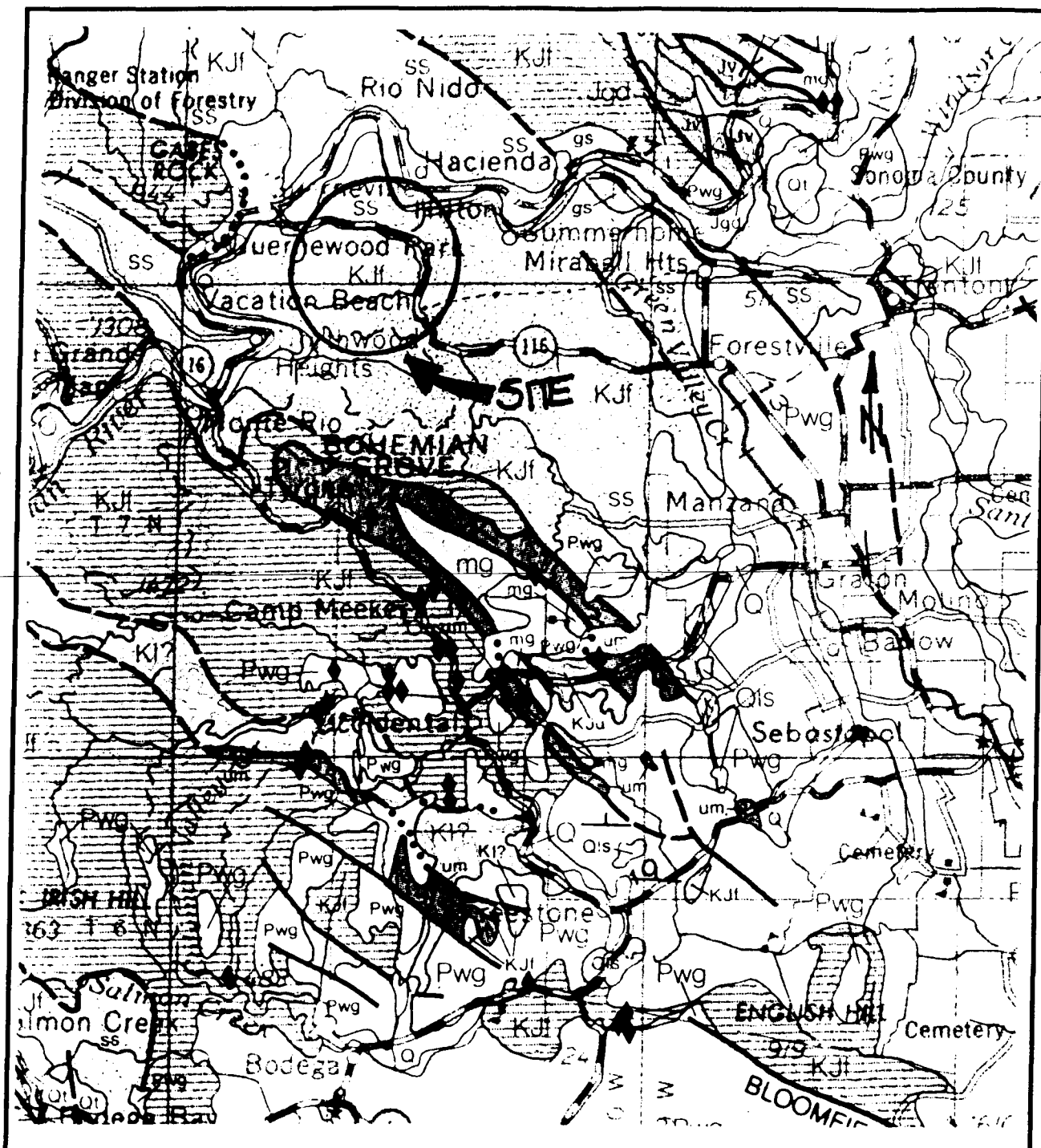
- Figure 1. **Vineyard Site and Watershed Area Map**
USGS 7.5 minute Quad Map: Guerneville
Scale: 1" = 2000', 40' contours
- Figure 2. **Vineyard Geologic Setting**
California Division of Mines and Geology, Special Report 120
- Figure 3. **Vineyard Soils**
USDA-NRCS Sonoma County Soils Survey Map #71
- Figure 4. **Vineyard Hydrology - Rational Method Calculations**
- Figure 5. **Watershed Yield Calculations and Pipe Sizing**
- Figure 6. **Irrigation Demand and Reservoir Size**
- Figure 7. **Vineyard Installation - Timeline**
- Figure 8. **Vineyard Maintenance - Annual Checklist**
-
- Figure 9. **Paul Hobbs Winery, Hillick Vineyard
Erosion Control and Drainage Plan**
24" x 36" drawings
C1: Plan view at Scale: 1" = 150', estimated 10' contours
(Adapted from USGS 7.5 minute Quad Map: Camp Meeker)
C2: Erosion Control Plan Specifications and Standard Details



Paul Hobbs Vineyard - Site Location

Erickson Engineering Inc.
Valley Ford CA 94972-0446
707/795-2498 Voice/Fax

January 15, 2006
USGS 7.5min Quad Map: Camp Meeker
Scale: 1" = 2000' Contour Interval 40'



Paul Hobbs Vineyard - Geologic Setting

Erickson Engineering Inc.
Valley Ford CA 94972-0446
707/795-2498 Voice/Fax

January 15, 2006

California Division of Mines and Geology
Special Report 120, Plate 2A, Santa Rosa, Ukiah Quadrangles

$$Q = C * i * A * K$$

C = .40 vegetated 20% slopes

i = 2.4 in/hr 100_{yr}-15_{min}

A = Acres area

K = 50" local avg/30" baseline avg

$$Q_{100_{yr}-15_{min}} = .4 * 2.4 * 5/3 * A$$

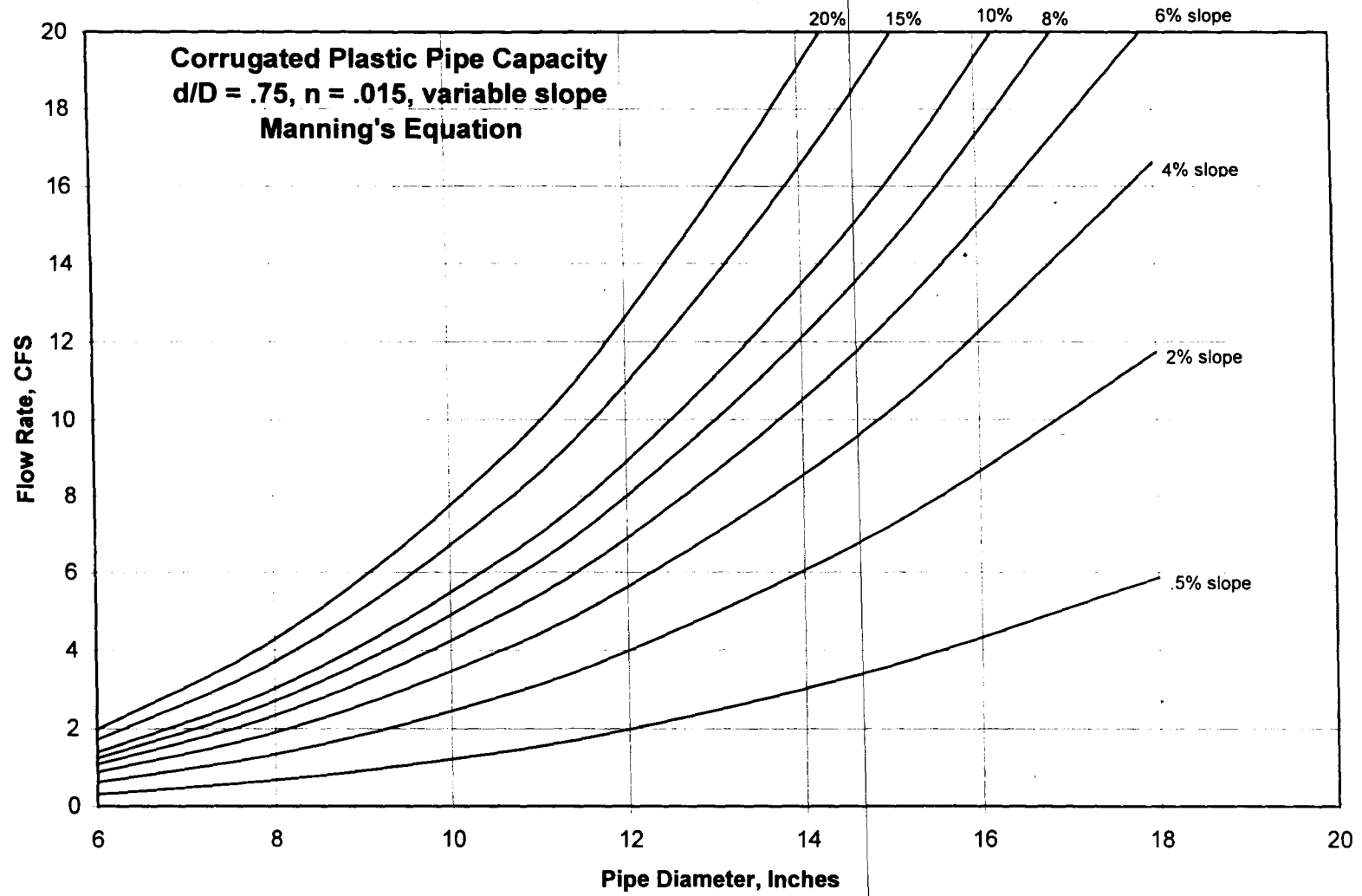
$$= 1.6 \text{ CFS/Ac}$$

Paul Hobbs Winery, Hillick Vineyard - Hydrology by Rational Methods

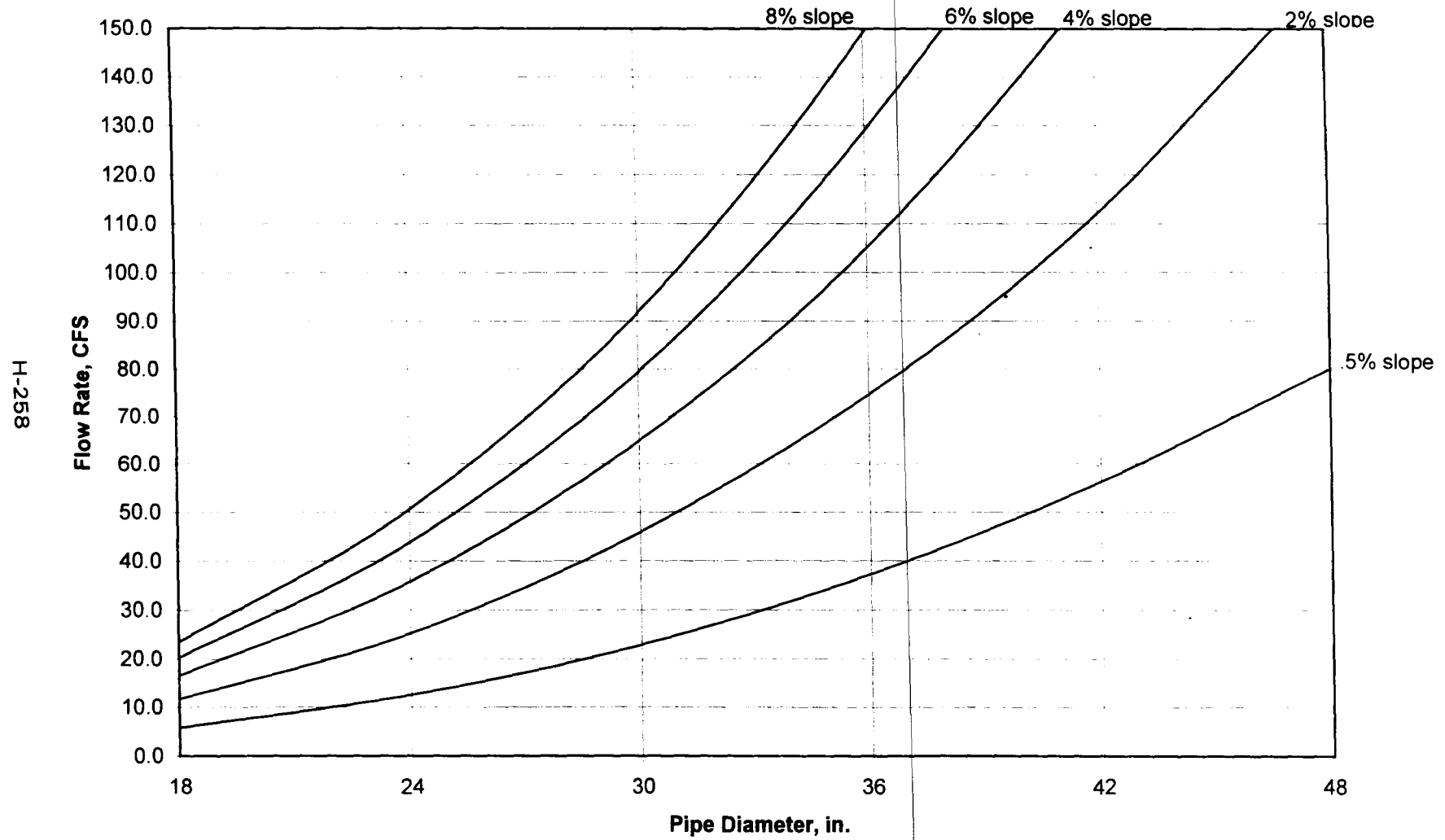
Erickson Engineering Inc.
Valley Ford CA 94972-0446
707/795-2498 Voice/Fax

January 16, 2008

H-257



Corrugated Plastic Pipe Capacity
 $d/D = .75$, $n = .015$, variable slope
Manning's Equation



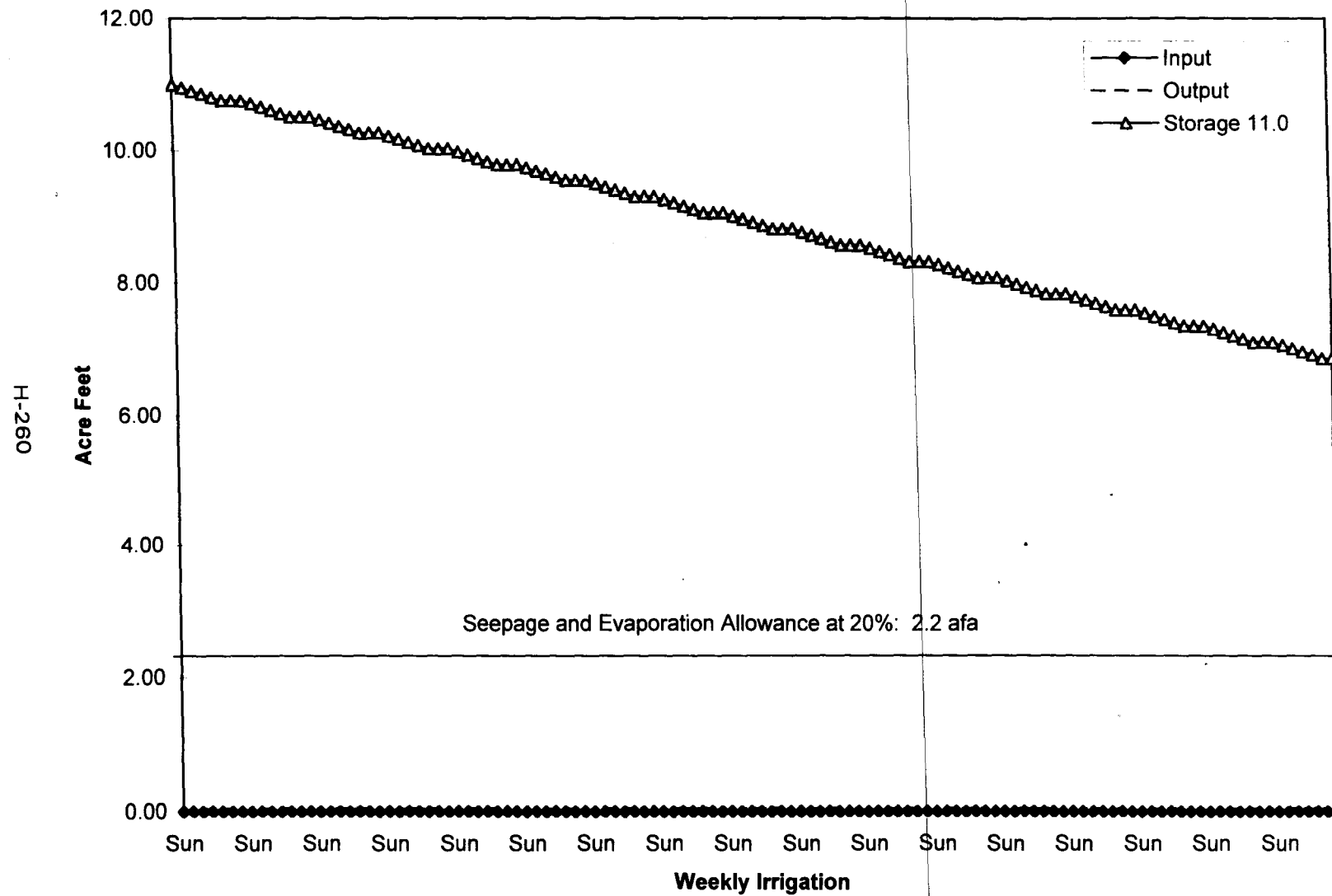
Irrigation and Frost Protection Water Storage Requirements

Erickson Engineering Inc, Valley Ford CA 94972-0446

Hillick Vineyard 11835 Highway 116 Guerneville CA 95446		File: xl/projects/benbow/irrig Time: 08:45 PM Date: 20-Jan-08 Updated: 20-Jan-08	
Irrigation Data:		Required Flow:	
Vineyard Area:	11.0 acres	5.81 gal/vine	100
Block Area:	0.6 acres/block	1245 gph/ac	gal/vine/year
Rows:	7.00 ft wide	20.7 gpm/ac	
Vines:	5.00 ft apart	7236 gal/ac/set	
Vines/ac:	1244.6 vines	3980 gal/block/set	
Drip gph/vine	1.00 gal/hr/vine	17.2 sets/season	
Irrigation set:	5.8 hours	68451 gal/block/season	
Irrig frequency:	7.0 days between sets	20.0 blocks	
Irrig season:	17.2 weeks	1369029 Total gal/season	
Seep/Evap loss:	20 percent	4.2 Acre Feet/season	
	5.0 Req'd Season Storage	0.381 acre-feet/acre/year	
Irrigation Output			
	5.0 days/cycle (week)	(change daily data in chart table)	
	4.00 blocks/day/cycle	11 gpm/block	
	15918.9 gal/day discharge	46 gpm, simultaneous blocks	
	0.048792 ac-ft/day discharge	23.3 hours irrigation, sequential	
Spring/Well Recharge:			
Rate:	0.00 gal/min	0.00 ac-ft/day	
Period:	24.0 hr/day	0.00 ac-ft/irrig period	
Volume:	0 gal/day	0.00 ac-ft/mo	

Frost Protection Data		Required Flow:	
Area:	0 acres	0.00 gpm	
Sprinkler rate:	55 gal/min/ac	0.00 cfs	
Set time:	8 hours	26400 gal/ac/night	
Nights Required:	6 nights	0 gal/night	
	1100 vines/ac	0.00 ac-ft/night	
Spring/Well Recharge:		Required Storage Volume:	
Rate:	0.00 gal/min	0.08 ac-ft Per acre per night	
Period:	0 hr/day	0.00 ac-ft Total per night	
Volume:	0 gal/day	0.00 ac-ft Season frost vol required	
	0.00 ac-ft/day	0.00 ac-ft recharge reduction	
	0.00 ac-ft/frost period	0.00 ac-ft Req'd min useable storage	
	0.00 ac-ft/mo		

**Hillick Vineyard - 11 Acres @ 1250 vines/ac.
11 AF Reservoir, 0 GPM/24hr recharge, 5.8 g/vine/wk (0.380 afa) 17 Weeks**



Project Time Line - Erosion and Sediment Controls
Section 30-74 Hillside Vineyard Ordinance

File Excel/eei/vineyard/timeline

Paul Hobbs Vineyard
 11385 Highway 116
 Guerneville CA 95446

11:14 AM 17-Jan-06

Updated: 17-Jan-06

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year 1												
High Erosion Potential												
Site Evaluation												
Tree cutting												
Land Clearing												
Temporary Measures												
Plant Cover Crop												
Erosion Controls												
Stormwater controls												
Systems Maintenance												
Year 2												
Construction layout												
Grading, earthwork												
Roadwork												
Permanent Measures												
Plant Cover Crop												
Stormwater controls												
Sediment controls												
Systems Maintenance												
Year 2 or 3												
Plant Vines												
Permanent Measures												
Plant Cover Crop												
Stormwater controls												
Sediment controls												
Systems Maintenance												
Agronomic Maintenance												
Pruning												
Fertilizing												
Mow cover crop												
Weed control												
Tillage												
Viticulture/harvest												
Systems Maintenance												

Timeline may be accelerated at discretion of Owner and Vineyard Management so long as work is in conformance with County statutes and regulatory agency requirements.

Vineyard Erosion Control System Maintenance Checklist

Version 1.03

Checklist to be completed by vineyard manager prior to October 15. Check all field installations that apply for each review category. Note repairs needed, if any, and provide date of completion of repair work. Send copies to Landowner.

Reviewer: _____ Date completed: _____

Field Access Roads and Perimeter Avenues:

1. Culverts: Inlets, outlets, rock cover, debris.
2. Ditches: Rock armor, scour, debris, capacity.
3. Waterbars: Location, condition.
4. Surface: Slope, crown for water control, surface loss prevention to waterways
5. Cut/fill slopes: Stable, well vegetated.

Vineyard Reservoir, if present:

1. Spillway/outlet armor, condition.
2. Embankment cover crop.

Hillside Terraces, if present:

1. Cut and fill slopes: Stable, in good repair. Armor/buttress/repair as required.
2. Inboard ditches: Clean, uniform slope, no debris or flow restrictions.
3. Drainage inlets: Clean, functional, correct elevations, not plugged.
4. Cover crop: Complete, uniform coverage. Replant and irrigate as required.

Swale Drains:

1. Inlets: Clean, functional, correct elevations, not plugged.
2. Inlets: Satisfactory location(s) for performance. Add/adjust as needed to control water.
3. Outlets: clean, functional, armored, discharge erosion prevented.
4. Outlets: discharge to sediment trap where appropriate.

Subsurface Drains:

1. Outlets: clean, functional, armored, discharge erosion prevented.
2. Satisfactory location(s) for performance. Add/adjust as needed to control water.

Sediment Retention Structures, if present:

1. For sediment accumulation, determine upland source(s) and remediate.
2. Excavate annual accumulation, redistribute uniformly in upslope areas.
3. Check inlet, outlet, armoring for satisfactory condition, operation.

Vegetation Management:

1. Evaluate permanent cover crop for vigor, health. Irrigate/fertilize/improve as required.
2. Provide straw mulch or other erosion control cover where poor cover exists.
3. Repair and provide hand mulching of problem sheet/rill erosion areas if required.

Special conditions requiring maintenance or repair work by vineyard management:

